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(54) INORGANIC FELT COVERED GYPSUM BOARD

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INORGANIC FELT COVERED GYPSUM BOARD

Abstract of the Disclosure

A relatively thin inorganic fibrous sheet is adhered to a major side of a panel core comprising a matrix of hydration set calcium sulfate. Cementitious material is disposed within an elongated joint defined by adjacent panels secured to a supporting structure. A tape of substantially the same fibrous material as the sheet is adhered to the cementitious material and longitudinally overlaps portions of the panels adjacent each side of the joint. The sheet and tape are dimensionally stable under moist conditions and provide the exterior surface of the panel installation with relatively consistent absorptive and textural characteristics.

INORGANIC FELT COVERED GYPSUM BOARD

Background of the Invention

Field of the Invention

This invention relates to an improved gypsum wallboard and its manufacture and installation.

Description of the Prior Art

In the manufacture of gypsum wallboard of the conventional type the cover sheet used comprises news print or ground wood in the form of a multiply paper, but to date considerable problems inherent in such cover sheets have not been solved. One problem in this field is to find a cover sheet which can become wet with water during either the dressing of joints developed by abutting wall boards or the subsequent absorption of moisture from the atmosphere without swelling at the joints. When the swelled portions of the cover sheet eventually dry, the material which has swelled does not always return to its original size but continues to retain a somewhat enlarged shape. This shape is often in the form of ridges or protrusions called beads. Another problem in this field is to reduce the length of time required to reinforce and conceal the joints.

Conventional joint dressing operations generally involve filling the joints between abutting panels with cement, to which a paper tape is applied. The cement is then allowed to dry within the joints, during which time it tends to shrink. In the preceding manner the joints are repeatedly filled with cement, taped, and allowed to dry until the tape contacting each dried cement filled joint is substantially flush with its adjacent panel surfaces. The exterior surface of the wallboard installation may then be painted.

It has been proposed to solve the above problems by filling the concavity formed by the beveled edges of abutting paper covered panels with quick drying cements having high solids and low water contents. Such cements decrease swelling during joint dressing operations but do not prevent the formation of beads, ridges or protrusions caused by the subsequent absorption of moisture from the atmosphere. It has also been proposed to apply a fiber glass mat over the cement reinforced beveled edges of a gypsum core sandwiched by cellulosic sheets. Such methods not only fail to appreciably reduce swelling and beading at the joints, but provide the surface of the tape with absorptive and textural characteristics different from those found on other areas of the panel. These differences in (1) the amount of liquid which on contact with a coversheet or tape passes to the interior of the coversheet or tape, hereinafter referred to as absorptive differences, and (2) texture are even present when the joints between paper covered panels are filled with cement and taped with a paper tape, and generally require additional dressing operations and lower installation rates than it has been desirable to attain for commercial operations. The problem which it is the primary objective of the present invention to solve, is to produce a gypsum wallboard which is less susceptible to the formation of ridges or protrusions. In addition it would be desirable if the joints developed by abutting wallboards could be rapidly reinforced and concealed without creating on the surface of the tape applied to conceal the joints absorptive and textural characteristics, substantially different from those existing on other areas of the panels.

Thus an object of the present invention is to provide a gypsum wallboard having fibrous cover sheets which

will not swell during or after installation.

Another object of the present invention is to provide an improved gypsum wallboard installation in which the absorption and texture on the exterior surface of the tape applied to conceal joints between abutting wallboards and on the remaining exterior portions of the panels are relatively consistent.

Summary of the Invention

To accomplish the stated objects an aqeuous slurry comprising hydration setting calcium sulfate, such as a hydraulically setting cement comprising about 85 percent gypsum, is disposed within and converted into a hardened core in board form between upper and lower cover sheets or mats which are relatively porous and which are dimensionally stable in the presence of moisture. A cover sheet which is dimensionally stable in the presence of moisture will retain its shape upon exposure to water and will not swell under moist conditions. The cover sheet should be sufficiently porous to permit part of the gypsum slurry to penetrate through a substantial thickness of the sheet and bond with a sufficient number of fibers located within an interior portion of the sheet to firmly adhere the felt to the core. Joints developed by abutting panels are filled with the hydraulically setting gypsum cement to which a tape which has substantially the same absorptive and shape retaining characteristics as the cover sheets can be applied so that part of the gypsum slurry wets through and is deposited on top of the tape. It has been discovered that the use of a glass fiber cover sheet can result in the elimination of swelling problems and the formation of ridges or protrusions caused thereby.

In addition, a wholly unexpected result of the use of cover sheets and tapes which comprise glass fibers has been the ability, in wallboard installations including the same, to provide the entire surface with water absorption and textural characteristics which are considerably more uniform than are produced by conventional joint treatment of conventional cellulosic sandwiched gypsum cores. The joint cement when once set will not shrink even though evaporation of free water must still take place. Panel joints thus filled with cement and taped can be provided with a thin sheer coat of a standard drying type or joint cement to fill any interstices remaining between the glass fibers even though the joint cement is not dry, and painted without having to sand or feather the joints. Depending upon drying conditions, the time required to reinforce and conceal the joints can range from two to four days less than that generally consumed during conventional joint filling, taping, and painting operations.

Significant structural features are incorporated into the elements of my novel invention, whereby the provision of glass fiber cover sheets reduces the panel's weight and permits the use of greater amounts of gypsum. The light weight board exhibits increased fire resistance and reduces shipping costs. Gypsum material has been found to dry from 10-15 percent more rapidly within the fiber glass cover sheets made in accordance with the present invention, thereby permitting the rate at which the panels are manufactured to be significantly increased.

Additional objects and advantages will in part be obvious and will in part appear hereinafter.

Brief Description of the Drawings

For a fuller understanding of the nature and objects of the invention, reference should be had to the

following detailed description taken in conjunction with the accompanying drawings wherein:

Figure 1 is an isometric view of one form of a fiber glass mat surfaced gypsum board.

Figure 2 is a section, taken on the line 2-2 of Figure 1.

Figure 3 is a diagrammatic front elevation of a portion of an apparatus for forming the article of Figure 1.

Figure 4 is an isometric view of a fiber glass reinforcing tape for use in installing the panels of Figure 1.

Figure 5 is a fragmentary sectional view of applied panels incorporating the embodiment of the invention pictured in Figure 1.

Figure 6 is a fragmentary section of applied panels incorporating an alternate embodiment of the invention.

Description of the Preferred Embodiments

Referring to the drawing, there is illustrated in Figure 1 a panel 10 comprising a hardened gypsum core 12 disposed between an upper and lower cover sheet or mat 14. The sheet 14 generally includes discontinuous individual glass fibers 16 randomly distributed throughout the felt. While the glass fibers have been illustrated as being in the form of discontinuous individual filaments, they obviously may be incorporated in the sheet 14 as other types of randomly distributed filaments, such as continuous strands or yarns, and may also be in the form of woven or unwoven fabric, although in general, fabrics will be found more expensive. Where randomly distributed continuous glass strands are employed they are preferably each of a plurality of continuous glass fibers extending over the major dimensions of the sheet. Where fabrics are employed, at least some of the fibers are preferably caused to extend in random directions. It will be

understood, however, that for particular purposes it may be desirable to employ some other orientation of the filaments. It should be noted that the showing of glass fiber in the drawings is only for the purpose of indicating a more or less random arrangement of a significant portion of the filaments, and should not be considered as an accurate illustration of the fiber. Preferably, sheet 14 whether in the form of randomly oriented fibers or a woven fabric, weighs from about 0.75 to about 3 pounds per 100 square feet.

The gypsum core 12 illustrated in Figure 1 is of the same general character as commercial gypsum cores, such as the 1/2 inch, 1.8 pounds per square foot cores commercially covered by cellulosic sheets. Surprisingly, however, sheets 14 can be several times lighter than conventionally employed paper cover sheets, sheets 14 weighing from about 1/2 to about 1/10 of the approximate 7 pounds per 100 square feet weight of such conventional paper cover sheets. More than the conventional amounts of gypsum can therefore be disposed per unit area between sheets 14 without increasing the weight of panel 10. Sheet 14, when keyed to the gypsum core 12, is substantially no thicker than a corresponding paper covering. The non-combustible property of sheet 14 and the additional quantity of gypsum per unit area which the light weight covering permits increase the fire resistance of panel 10.

In Figure 2 there is illustrated a section of panel 10. During the formation of core 12 an aqueous slurry of settable gypsum has wet through sheet 14 to produce a mechanical key. Evaporation of free water from the gypsum has left a gypsum residue 18 generally uniformly distributed over the surface 20 of sheets 14. The residue is generally comprised of gypsum material which migrates through sheets 14 and is adhered together on the panel surface. As

illustrated in Figure 2, residue 18 tends to fill the interstices between filaments 16 on the surface 20 of sheets 14.

Resinous binders may be employed in a conventional manner to manufacture the glass fiber sheets 14 and may comprise any of those thermoplastic or thermosetting resins heretofore used which will provide the glass fiber sheets with sufficient strength to prevent delamination, the more extensively employed resins being phenolics, elastomers such as neoprene rubber, vinyl binders such as polyvinyl acetate, and butyl binders. Such binders as are used should provide felt 14 with sufficient laminar strength to bond with the gypsum slurry without shearing. The selection of a particular resin will, of course, depend upon the uses to which the product is to be adapted, and such considerations will be well understood by those skilled in the art.

In Figure 3 there is shown a portion of an apparatus by which the product of Figure 1 may be produced. The ingredients which form the gypsum core 12 of panel 10 are combined in mixing tank 22. Such ingredients can include calcined gypsum as well as other conventional ingredients normally used in the manufacture of gypsum, such as water, pulp, starch, cellulosic fibers and minor additives. The ingredients are fed into mixing tank 22 through suitable conduits (not shown). The mixed slurry falls from outlet or outlets 32 in mixer 22 onto a moving felt 14 of glass fibers which is supported and advanced by conveyor belt 34. The slurry is moved by conveyor belt 34 in the direction of the arrow toward the forming section of the apparatus which includes a forming roll 36. An upper glass fiber cover sheet or sheet 38, fed from above to forming roll 36, passes under the forming roll simultaneously and at substantially

the same rate as the lower glass fiber cover sheet 14. The amount of gypsum slurry carried with and between cover sheets 14 and 38 is determined by the opening dimension 40 between forming roll 36 and conveyor belt 34. Such dimension can be adjusted to form a predetermined thickness of fiber glass covered, settable gypsum core panels 10. A bank 42 of settable gypsum slurry is caused to accumulate and remain at a suitable size, as illustrated in Figure 3, just ahead of the point where the panel 10 is formed. As the aqueous gypsum slurry 35, which can be said to comprise a matrix of hemihydrate calcium sulfate, passes beneath forming roll 36, pressure is exerted on slurry 35 and on felts 33 and 38 which causes sheets 33 and 38 to become partially embedded in slurry 35. After being formed, panels 10 are cut by knife 43 and dried in drier 44 to set the gypsum core.

While the apparatus as broadly described above is entirely conventional and is operated in a conventional manner, the glass fiber covered gypsum board produced thereon contains a number of advantages over conventionally produced paper covered gypsum board. For example, fiber glass covered panels made in accordance with the present invention have been found to dry from about 10-15 percent faster than a paper covered board of corresponding thickness. This faster drying rate can be utilized to permit an increase in machine speeds of from 10-15 percent. The invention additionally permits the use of cover sheets weighing approximately 1/2 to 1/10 of the weight of the sheets conventionally employed, and which increase the panel's ability to resist combustion. Even more significant than the reduced shipment costs, increased production rates and improved fire resistance permitted by the glass fiber cover sheets, is the ability

of the fiber glass cover sheet to become wet with water without encountering swelling problems and the formation of ridges or protrusions caused thereby. Not surprisingly, an article which has the above noted properties has been long but unsuccessfully sought, for the articles of the present invention are the first articles known to me in which a glass fiber sheet has been bonded to a gypsum core in place of a paper cover sheet.

Referring to Figure 4 a reinforcing tape 46 of substantially the same fibrous material as the sheet 14 used as a cover sheet for panel 10, is shown. Like sheet 14, tape 46 preferably weighs from about 0.75 to about 3 pounds per 100 square feet. As illustrated in Figure 5, the panels 10 can be installed in the conventional way in abutting relationship during construction of a wall or ceiling, for example. Joint 48 developed by abutting panels 10 is filled with a cement 50 of the hydraulically setting variety, such as a cement comprising approximately 85 percent gypsum, which will not shrink when once set even though free water has not evaporated from the cement 50. Tape 46 is applied in the conventional manner above the cement filled joint 48 before cement 50 sets. As previously discussed in connection with Figure 2, during formation of the gypsum core 12 and prior to the setting step, some of the aqueous slurry of settable gypsum wets through the glass fiber sheets 14 and 38 to adhere the sheets to the core 12. In the event that a gypsum slurry was disposed between an upper and lower paper cover sheet in the conventional way, the slurry would not penetrate through the paper. As a result the residue 18 which is generally uniformly distributed over the surface 20 of sheet 14, would not be present on the surface of a paper covered gypsum board. If a paper tape were applied to longitudinally overlapped portions of the

panels adjacent each side of the cement filled joint 48, the gypsum cement would not penetrate through the paper. When tape 46 is applied to longitudinally overlapped portions of the panels adjacent each side of joint 48 before cement 50 sets, some of the gypsum wets through tape 46 to produce a residue 52 generally uniformly distributed over the surface 54 of tape 46. Surprisingly, residue 52 is present on the surface 54 of tape 46 in relatively the same amount per unit area as residue 18 is present on the surface 20 of sheet 14.

The application of either tape 46 or a paper tape (not illustrated) to longitudinally overlapped portions of the panels adjacent each side of joint 48 causes small amounts of joint cement 50 to ooze beyond the edges 56 of the tape. When the joints of a paper covered panel which have been filled with joint cement and taped with paper tapes are painted, the dissimilar absorptive and textural characteristics of the paper and cement tend to reveal the presence of the joints. This problem is not present when panels are installed in accordance with the present invention. Gypsum cement 50, oozing beyond edges 56 of tape 46 has relatively the same absorptive and textural characteristics as the residue of gypsum cement generally uniformly distributed over surface 20 of sheet 14 and over surface 54 of tape 46. When a single coat of paint is applied to panels 10 the joints of which have been filled with cement 50 and taped with tape 46, the similarity of texture and absorption created across the joints 48 of such panels produces a wall or ceiling surface which is strikingly more uniform in appearance than that generally attained in conventional joint treatment of paper faced gypsum core panels. In the event that residue 18 or 52 does not fill the interstices between filaments 16 of sheet 14 or tape 46, a conventional

joint cement can be applied by a roller and immediately sheared off with a trowel or other suitable device to leave a relatively thin smooth film of cement. The panels illustrated in Figure 6 received the sheercoat 62 of cement before being provided with a single coat of paint 64. As previously indicated, however, the presence of residues 18 and 52 will frequently obviate the necessity for applying the additional sheer coating of cement. The sheer coat of cement, if applied, can act as a primer coat for a far more satisfactory one coat paint job than could be attained with paper faced gypsum core installations. Moreover, panels constructed and installed in accordance with the present invention need not be redressed with a fill coat or sanded. Inasmuch as conventional casein type cements take approximately one day to dry and the sanding operation can consume another day, and since the fiber glass tape 46 and cover sheets 14 retain their shape when wet and can be treated with a thin coat of cement or painted even though cement 50 is not dry, the time required to reinforce and conceal panels 10 with cement 50 and tape 46 is about two days less than presently required for conventionally installed panels under favorable drying conditions and up to four days less when drying conditions are poor.

Having thus described my invention in rather full detail, it will be understood that these details need not be strictly adhered to but that various changes and modifications may suggest themselves to one skilled in the art, all falling within the scope of the invention as defined by the subjoined claims. For example, it will be apparent to those versed in the art of producing and installing panels in which the core comprises a matrix of hydration set calcium sulphate that there are many fibrous sheets which retain their shape when exposed to water which have a porosity such that the gypsum

slurry can penetrate the sheet, and which can be superimposed over and partially embedded in at least one side of core 12. The panels could be installed with the form stable cover sheet to the outside and taped with a tape comprising the same material as the outer sheet cover sheet. During manufacture of such panels some of the anhydrous calcium sulfate disposed between such sheets would penetrate through the sheet to produce a mechanical key. The surface of the panel and the surface of the tape applied to joint cement disposed between joints developed by abutting panels would each contain a residue of hydration set calcium sulfate generally uniformly distributed thereover in relatively the same amount per unit area. Inasmuch as the absorptive and textural characteristics of the dried and set residue would generally correspond to that of the hydration set calcium sulfate disposed between the joints, a texture and absorption would exist across the joints which would be considerably more uniform in appearance than the texture and absorption present if conventional paper faced panels were to be dressed in like manner. Since the dimensionally stable cover sheet would not swell, beading problems such as the formation of ridges and protrusions caused by the swelling of moisture laden paper cover sheets, would be significantly reduced.

WHAT I CLAIM IS:

1. A panel, comprising:

(a) a core comprising hydration set calcium sulfate;

(b) a relatively thin glass fiber sheet adhered to at least one major side of the core, a portion of the fibers comprising said sheet being exposed on the exterior surface of said major side;

(c) the core material penetrating sufficiently through a substantial thickness of the sheet and bonding with a sufficient number of fibers located within an interior portion of the sheet to firmly adhere the sheet to the core; and

(d) a substantial number of interstices between adjacent fibers at the exterior surface of the sheet containing portions of the core material.

2. A panel as recited in Claim 1, wherein said sheet is adhered to each major side of the core.

3. A panel as recited in Claim 1, wherein said sheet comprises randomly oriented fibers and weighs from about .75 to about 3 pounds per 100 square feet.

4. A panel as recited in Claim 1, wherein said glass fibers are in the form of a woven fabric and the sheet weighs from about .75 to about 3 pounds per 100 square feet.

5. A panel as recited in Claim 1, wherein said core material is generally uniformly distributed over the exterior surface and substantially fills the interstices.

6. A panel support construction, comprising:

(a) a supporting structure;

(b) a plurality of panels secured to the supporting structure;

(c) each panel having a cementitious core comprising hydration set calcium sulfate;

(d) a relatively thin inorganic fibrous sheet which retains its shape under moist conditions and having dimensional stability, said sheet being adhered to at least one major side of the core;

(e) the core material penetrating sufficiently through a substantial thickness of the sheet and bonding with a sufficient number of fibers located within an interior portion of the sheet to firmly adhere the sheet to the core;

(f) at least one elongated joint defined by edges of adjacent panels secured to the supporting structure;

(g) a cementitious material disposed within and substantially filling the joint;

(h) a fibrous tape having substantially the same physical characteristics as the fibrous material of said sheet adhered to said cementitious material and longitudinally overlapping portions of the panels adjacent each side of the joint;

(i) the cementitious material within the joint penetrating sufficiently through a substantial thickness of the tape and bonding with a sufficient number of fibers located within the interior portion of the tape to firmly adhere the tape to the cementitious material.

7. A panel support construction as recited in Claim 6, wherein said sheet and said tape each comprise randomly oriented glass fibers and weigh from about .75 to about 3 pounds per 100 square feet.

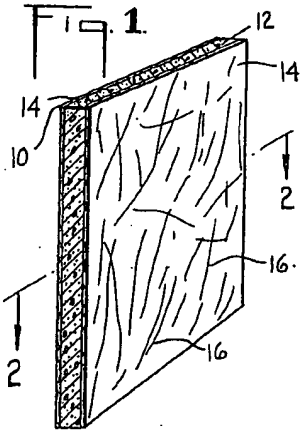
8. A panel support construction as recited in Claim 6, wherein a substantial number of interstices between individual fibers on the exterior surfaces of said sheet and of said tape contain a residue comprising the cementitious material.

9. A panel support construction as recited in Claim 8, wherein the residue is generally uniformly distributed over the exterior surface of said sheet and of said tape and fills

the interstices between fibers located on the exterior surface of said sheet and of said tape.

10. A panel support construction as recited in Claim 6, wherein the cementitious material within the joint comprises a matrix of hydration set calcium sulfate.

Fig. 1.



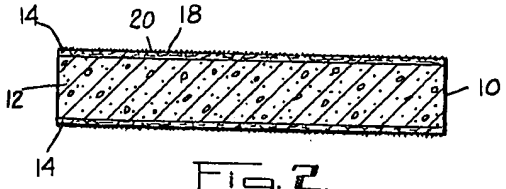
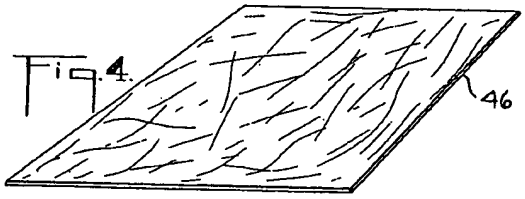


Fig. 2.

Fig. 4.



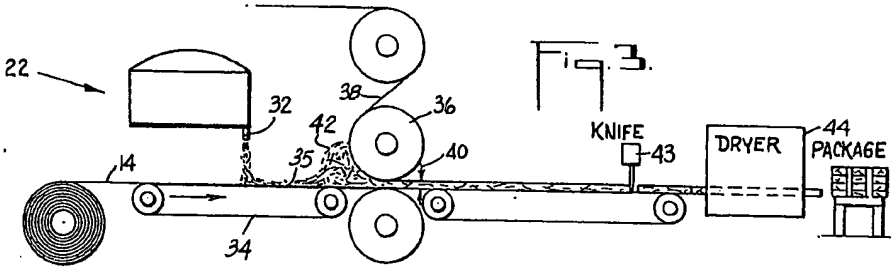
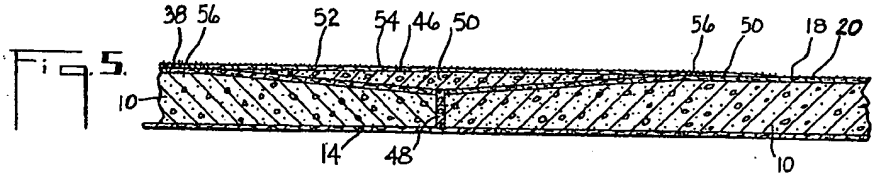


Fig. 3.

Fig. 5.



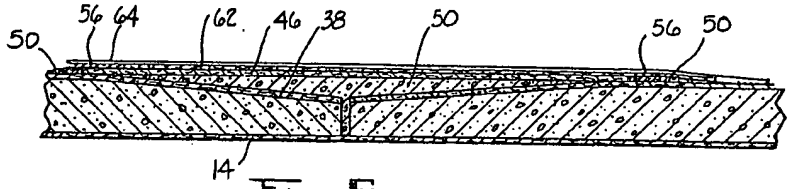


Fig. 6.

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